PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 9498/WO/UR	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/IB 2003/006021	International filing date *(day/month/year)* 16-12-2003	Priority date *(day/month/year)* 19-12-2002
International Patent Classification (IPC) or national classification and IPC G05B 9/00,G09F 1/00		
Applicant ABB AS et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
30-06-2004	14-04-2005
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Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-10 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 1-5 received by this Authority on 13-04-2005
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-2 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	---	NO
Inventive step (IS)	Claims	2-14, 16-20	YES
	Claims	1, 15	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	---	NO

2. Citations and explanations (Rule 70.7)

This report concerns the new claims which were received on 13-04-2005.

The application is concerned with a problem how to increase the safety level of a controller for control of real-world objects without adding to much complexity to the control system.

Documents cited in the International Search Report:

D1. DE 10025085 A1
D2. EP 0905594 A1
D3. WO 9323270 A1

D1, which is considered to represent the most relevant state of the art, discloses a module which connects to a machine. The module controls safety related functions in the machine. Different programs can be downloaded to the module through a local are network (see abstract and claim 1). Thus, it is known by D1 to:

- Connect a security module to a machine.
- Download security related program to the module.
- Configure the module according to a downloaded program and use the module for controlling the functions of the machine.

D2 and D3 are background art documents and are not considered to be of particular relevance.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

Claims 1 and 15:

The new claims 1 and 15 differ from the original claims 1 and 15 in that the control system is defined as a 1-channel system. The system in D1 has a 2-channel structure. However, this difference is not considered to confer any element of inventive significance regarding the art known from D1. Thus, the invention according to the independent claims 1 and 15 is considered to lack an inventive step. The invention according to these claims is industrially applicable.

Claims 2-14 and 16-20:

The invention according to these claims is considered to be novel and to include an inventive step. The invention according to claims 2-14 and 16-20 is also considered to be industrially applicable.

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CLAIMS

1. A method to increase the safety integrity level of a Controller (10) for control of real world objects,
characterized by,
- attaching to the said single (1-channel) Controller (10) a safety-hardware unit (11) wherein the safety-hardware unit (11) communicates with the said Controller's CPU,
- downloading safety-related configuration data and/or diagnostic information to the attached safety-hardware unit (11) and downloading the control function software to the Controller (10),
- configuring the attached safety-hardware unit (11) to execute logic, which depends on the downloaded safety-related configuration data and/or diagnostic information, and in an active or passive way set the Controller's (10) output values to a safe state for online safety control.

2. A method according to claim 1,
characterized in that
the Controller (10) have the capability of executing a set of non-safety critical control functions, which set of non-safety critical control functions is the same before as well as after the safety hardware unit (11) is attached.

3. A method according to claim 2,
characterized in that
the configuring step comprise the additional steps of
- downloading to the attached safety hardware unit (11) diagnostic information, which previously was automatically generated by a software tool as a result of user's configuration of the Controller (10) and which

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diagnostic information is used in the attached safety hardware unit (11) during safety critical control.

4. A method according to any previous claim, **characterized** in that access to a plurality of input and output values of a real world object is obtained through a bus (14) connected between the Controller (10) and to an input/output unit (15) and the validity of the bus (14) communication is verified in the attached safety hardware unit (11).

5. A method according to any previous claim, **characterized** in that the timing supervision of the Controller (10) is verified in the attached safety hardware unit (11).

6. A method according to any previous claim, **characterized** in that correct sequence of code logic is verified in the attached safety hardware unit (11).

7. A method according to any previous claim, **characterized** in that correctness of memory content of the controller (10) is verified in the attached safety hardware unit (11).

8. A method according to any previous claim, **characterized** in that a download of new control functionality logic to the Controller is verified in the attached safety hardware unit (11).

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9. A method according to any previous claim, **characterized** in that the attached safety hardware unit (11) performs checks in order to allow only users logged on as safety classified engineers and safety classified operators to modify the control functionality logic and parameters.

10. A method according to claim 4, **characterized** in that the bus (14) communication verification logic in the attached safety hardware unit (11) is implemented diverse.

11. A method according to claim 4, **characterized** in that the attached safety hardware unit 11 is diverse generating a safety related header for the bus (14) communication.

12. A method according to claim 11, **characterized** in that the Input/Output unit (15) has two diverse implementations each verifying the correctness of the bus (14) traffic and each generating a safety related header for the bus communication.

13. A method according to any previous claim, **characterized** in that the attached safety hardware unit comprise a first and a second module in a redundant configuration, the second module is updated with data that exists in the first module at the time of a failure and the second module takes over the safety related control of the control

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system from the first module if a failure of the first module is detected.

14. A method according to claim 13,
characterized in that
the a redundant Controller unit is attached to the Controller (10), which takes over in case of a failure of a primary Controller and the redundant Controller unit establish communication with either the active first module or the active second module of the attached safety hardware unit.

15. A single or 1-channel Control System (20) intended for safety-related control of real-world objects,
characterized in that,
- a single main CPU handling the main processes of a Controller (10),
- an attached safety-hardware unit (11) comprising means to increase the safety-integrity level of the Controller and comprising means to set the Controller's output values in a safe state for online safety control.

16. A Control System according to claim 15,
characterized in that
the Controller (10) have the capability of executing a set of non-safety critical control functions, which set of non-safety critical control functions is the same before as well as after the safety hardware unit is attached.

17. A Control System according to claim 16,
characterized in that it comprises,
- means for downloading to the attached safety hardware unit diagnostic information, which previously was

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automatically generated by a software tool as a result of user's configuration of the Controller and which diagnostic information is used in the attached safety hardware unit during safety critical control.

18. A Control System according to claim 17, **characterized** in that it comprises
- an input/output unit (15) connected to the Controller (10) by a bus and the validity of the bus (14) communication is verified in the attached safety hardware unit.

19. A Control System according to claim 18, **characterized** in that
the bus (14) communication verification logic in the attached safety hardware unit (11) is implemented diverse.

20. A Control System according to claim 19, **characterized** in that
the attached safety hardware unit (11) is diverse generating a safety related header for the bus (14) communication.